AD 741033

Measurements of Double Stars

Contract N 9 ONR - 84500

TEMPLE UNIVERSITY

FINAL REPORT

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September 22, 1949

Measurements of Double Stars

As called for in the schedule of this contract the Investigator conducted basic astronomical research involving interferometer measurements of double stars during the period of performance, June 1949 to September 1949.

The measurements of these stars were all performed by means of the 18 inch refracting telescope of Flower Astronomical Observatory, Upper Darby, Pa. The telescope was available for this purpose for half the night on 90 consecutive nights. Measurements of double stars were actually performed on 46 nights. On the remaining nights measuring work was impossible due to cloudiness or other adverse atmospheric conditions.

Altogether 191 separate positive measurements were made on 67 different stars. In addition 46 negative or uncertain observations were made on these same stars, and about 50 negative or uncertain observations of 30 other stars, many of which had been suspected of duplicity on indirect evidence. Thus, in total, 287 observations were made of 97 different stars. Seven of the suspected stars were confirmed as double by the interferometer.

Stars were chosen for observations on grounds of such rapid mutual gravitational motion that present measurements might contribute materially to determination of their orbits, and consequently, their masses. Knowledge of stellar masses is essential to astrophysical theories such as those concerning the source of energy for production of starlight. Since rapid revolution implies small separation of components of a double star there was great advantage in using the interferometer, which device more than

doubles the resolving power of telescope over the power when used in direct micrometric measurement. Thus for most stars having angular separation of 4/10 of a second of arc or less the interferometer was used, and for 22 interesting pairs which were wider and therefore within the resolution limit of the telescope, the more rapid direct micrometric method was used.

Insufficiency of light from faint stars is a very critical limitation to the usefulness of the interferometer. On the present project the efficiency of the interferometer was probably increased materially with application of a magnesium fluoride coating to all four surfaces of the eyepiece by the Optical Film Engineering Company of Philadelphia.

Although most astronomical effort during this period was concentrated on instrumental practice as described above, some opportunity was found for mathematical practice in computation of the orbit of a certain double star. This star, number 11h68 in Aitken's Catalogue, was noticed as having undergone considerable change of relative position since the previous interferometric measurements of it were made twelve years ago. These measurements, together with those made by three other astronomers, made possible a mathematical description of its past and future path or orbit. It turned out that one star makes a complete circuit around the other in about 185 years. The most extraordinary deduction is that the combined mass of the two stars is about 17 times the mass of our sun. Since such high massiveness has not been noted for any other visual binary star, and is quite rare in stars of any description, this accidental discovery may have special significance in astrophysical theories.

The measurements made and other pertinent details of the work done will be included in two papers by the Investigator to be published in the near future in the Astronomical Journal. Twenty-five copies of each will be forwarded as part of this report as soon as reprints become available.